Landscape and Urban Planning xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan

Perspectives of resource management professionals on the future of New England's landscape: Challenges, barriers, and opportunities

Marissa F. McBride[a,*], Matthew J. Duveneck[a], Kathleen F. Lambert[a,b], Kathleen A. Theoharides[c], Jonathan R. Thompson[a]

[a] Harvard Forest, Harvard University, Petersham, MA 01366, USA
[b] Science Policy Exchange, Harvard Forest, Harvard University, Petersham, MA 01366, USA
[c] Executive Office of Energy and Environmental Affairs, 100 Cambridge Street, Boston, MA 02114, USA

ARTICLE INFO

Keywords:
Family forest owners
Stakeholder perceptions
Non-industrial private forest owners
Landscape management
Private land conservation
Sustainability

ABSTRACT

New England is a predominately forested landscape in which 80% of the forest is privately owned and patterns of land use are the result of diverse landowners acting individually in response to shifting social and economic conditions. In aggregate, perspectives of regional stakeholders can help to inform the challenges and opportunities related to achieving sustainable land-use at the landscape scale in regions like New England. We conducted structured interviews with stakeholders—largely resource management professionals—working in fields related to land-use management (n = 57) to elicit their perspectives on the future of New England's landscape. The responses were analysed using qualitative content analysis and coded in terms of perceived challenges and opportunities for promoting sustainable land-use trajectories amidst conflicting priorities. The stakeholders overwhelmingly viewed ecological and social issues as interconnected rather than as distinct systems. They perceive the central challenges to sustainability to be: lack of funding and government support, increased development pressures, changing landowner demographics, and the difficulty of accounting for aggregate impacts in a dispersed planning context. The reduced ability of landowners to derive market values from their land was an overarching concern, with parcelization, fragmentation, and poorly planned development viewed as having a disproportionate impact on the character of the land and the potential to exacerbate the negative impacts of other drivers such as climate change. Perceived opportunities for promoting sustainable futures include improving the liveability of urban areas and quality of urban planning to encourage more compact forms of development, and realigning monetary incentives to recognize the collective benefits that forested landowners provide.

1. Introduction

The landscape of the eastern United States is in transition. A 150-year trend of forest expansion has recently reversed and the region is now losing forest-cover (Drummond & Loveland, 2010). The fate of these forests will be largely determined by the ten million diverse private woodland owners (i.e., family forest owners) who control more than half of the region's 150 million hectares of forestland (Butler, 2008). These private landowners act individually and in response to shifting socio-economic conditions (e.g., Huff, Leahy, Hiebeler, Weiskittel, & Noblet, 2015; Kittredge, Rickenbach, Knoot, Snellings, & Erazo, 2013; Kittredge & Thompson, 2016; Stone & Tyrrell, 2012), often in the absence of regional-scale land-use planning. Amidst the challenges of private forest ownership (Butler et al., 2016), individual landowners increasingly need to contend with pressures from encroaching development and fragmentation, climate change and invasive forest pests, a changing socio-cultural landscape, and a reduced ability to derive market values from their land (Stein, Carr, McRoberts, & Mahal, 2012). These pressures place the future of the many benefits that these lands provide to people and nature at risk (Kline & Alig, 2005; Seto, Fragkias, Güneralp, & Reilly, 2011; Smail & Lewis, 2009; Stein et al., 2005).

Private forest ownerships in the United States are defined as those held by individuals or families, corporations, tribes, estates, trusts, non-governmental organizations, and other non-corporate owners (Butler et al., 2016). Among these individual land owners, family forest

* Corresponding author at: Harvard Forest, Harvard University, 324 N Main St, Petersham, MA 01366, USA.
E-mail addresses: mfc.mcbride@gmail.com (M.F. McBride), mduveneck@fas.harvard.edu (M.J. Duveneck), klambert01@fas.harvard.edu (K.F. Lambert), jthomps@fas.harvard.edu (J.R. Thompson).

https://doi.org/10.1016/j.landurbplan.2018.10.019
Received 29 December 2017; Received in revised form 12 October 2018; Accepted 31 October 2018
0169-2046/ © 2018 Elsevier B.V. All rights reserved.

ownerships hold the most forestland of any ownership group. Private forest owners are viewed as an important group for research and support owing to their considerable number, the large amount of land they own, and the diversity of their ownership objectives and management practices. Private woodland ownerships are also constantly shifting hands, with considerable changes in ownership having taken place over the last 20 years and projected to continue (Butler et al., 2016). Since the 1990s, for example, millions of acres of industrial forests once owned by traditional forest products companies have been sold to institutional investors who manage for profit within much shorter investment cycles than that pursued by traditional industrial owners (D'Amato, Jokela, O'Hara, & Long, 2017; Daigle, Utley, Chase, Kuentzel, & Brown, 2012; L'Roe and Rissman, 2017). Accelerated changes in the ownership of smaller tracts of family forest holdings are also likely to occur in coming decades as an aging generation of owners transfers or sells off their landholdings and in response to a reduced ability to derive market values from their land (e.g., practicing forestry) (Butler et al., 2016; Markowski-Lindsay et al., 2018).

Against this backdrop of changing private forest owner demographics and motivations, the six-state New England region provides an important case study for understanding the challenges, opportunities, and motivations of private landowners and resource managers (Kittredge, 2005). New England, situated in the northeast corner of the U.S., is among the most forested and most populous regions of the U.S. Forest fragmentation due to suburban sprawl and rural development is increasing throughout the region (Olofsson, Holden, Bullock, & Woodcock, 2016), and dramatic shifts in land ownership are driving parcelization and subdivision (Kittredge, D'Amato, Catanzaro, Fish, & Butler, 2008; Stein et al., 2009). In some places, property values and taxes have increased such that conventional forest management is no longer able to 'pay its way' without the aid of landowner assistance programs (D'Amato, Catanzaro, Damery, Kittredge, & Ferrare, 2010; Kilgore et al., 2015). These changes, along with a shifting ownership base and culture have ignited concerns that sustainable land use in the region is at risk.

There are more than 800,000 private woodland owners in New England, 200,000 of which own more than 2.5 ha; they are the largest single ownership class in the region. Over the last thirty years, forest loss rates increased from 1990 to 2007 due in large part to low-density residential development. These trends in deforestation are expected to continue (Thompson, Plisinski, Olofsson, Holden, & Duveneck, 2017; Wear, 2011). Among forest owners, most of the transitions to developed uses have occurred within small private woodland owners who own most of the land close to the high population core areas of southern New England (Olofsson et al., 2016; Thompson et al., 2017). In contrast, the threat of development is much more limited in the northern New England states, where forests have largely stayed as forests over the last thirty years. Here the dominant land-use and owner class (e.g., public, corporate, private woodland owners) is timber harvesting, with rates of harvesting on private woodlands highest in rural northern New England (Thompson et al., 2017). Whereas in southern New England, rates of timber harvesting are lower, and more landowners rank non-consumptive uses of their forests, including aesthetics, privacy, recreation and wildlife habitat, above timber harvest or future development (Butler, 2008; Rickenbach & Kittredge, 2009).

In this landscape of thousands of private landowners there can be no top-down landscape scale conservation. Instead, working to counter the trends of forest loss is the region's strong network of private and public organizations that exist to support land conservation efforts and use a variety of approaches to assist land owners who wish to ensure a sustainable future for their lands (Labich, Hamin, & Record, 2013; Meyer, Cronan, Lilieholm, Johnson, & Foster, 2014). No centralized authority exists to regulate land use at the New England regional scale and instead it is loosely coordinated through a patchwork of regional planning entities, state policies and permits, and local planning boards (Sagor, Kueper, Blinn, & Becker, 2014). Amidst this dispersed decision context, concern for the fate of the region's forests and its natural infrastructure have led to calls for broad-scale land protection (e.g., Foster et al., 2010; Foster et al., 2017) and spurred research efforts aiming to provide a region-wide perspective on the drivers of land-use change and to help understand and anticipate alternative possible future land-use trajectories (e.g., McBride et al., 2017; Thompson et al., 2016).

Achieving large-scale shifts in land use within such a dispersed decision-making context requires the involvement and concerted, coordinated efforts of numerous stakeholders across multiple scales, including those whose livelihoods depend directly on forests (i.e., foresters, loggers, wood product manufacturers, people employed by the outdoor recreation industry), as well as private landowners, local communities, and government and nongovernment organizations (e.g., Fitzsimons, Pulsford, & Wescott, 2013; Foster et al., 2010; Guerrero, Mcallister, & Wilson, 2015; Sayer et al., 2013). In such settings, the design of effective land use and conservation initiatives benefits from an understanding of the social and institutional environment in which actions are to be implemented (Cowling & Wilhelm-Rechmann, 2007; Quinn & Wood, 2017; Santo, Sorice, Donlan, Franck, & Anderson, 2015). As part of exploring this social side of the decision context —the relevant motivations, attitudes, and external controls influencing human actors in the system—, considerable numbers of studies within the forest and land use literature have examined forest landowners' attitudes, motivations, and behaviours in relation to their forested land (e.g., Farmer, Meretsky, Knapp, Chancellor, & Fischer, 2015; Lindhjem & Mitani, 2012; Ma & Kittredge, 2011; Rabotyagov & Lin, 2013). However much less work has explored the perspectives and knowledge of the resource management professionals making up part of the network of organizations, programs and incentives that have evolved to assist private land owners and local towns (though exceptions exist; see for example Gobster, Stewart, & Bengston, 2004; Kilgore & Snyder, 2016; Knoot, Schulte, Grudens-Schuck, & Rickenbach, 2009; Rouleau, Lind-Riehl, Smith, & Mayer, 2016; Sagor et al., 2014). These representatives work across multiple scales and regularly engage both directly with private woodland owners through services like education and outreach, and indirectly through activities such as network coordination, research, policy development and advocacy (Kittredge, 2004). In doing so, these representatives are likely to possess a rich source of knowledge based on in-depth, first-hand experience of shifts in the land use and associated social and institutional environment in which actions are taking place.

Building on these ideas, this paper adopts a place-based perspective to explore and reflect on how representative stakeholders with responsibility for land-use planning and decision-making across multiple sectors and scales are thinking about and responding to perceived changes in the New England landscape over the next 50 years. We elicit the views of New England stakeholders for their unique perspectives and insights as potential 'change agents' with knowledge based on both direct and indirect engagement with landowners (Visser & Crane, 2010) and investigate the constraints and opportunities they perceive in negotiating transitions toward achieving broad-scale conservation and sustainable land use goals. Our focus on professionals' (as experts) perspectives, as opposed to those of private landowners, provides the opportunity to reveal information relevant to both a local scale and the wider region for privately owned forests, landowners and the social, political and economic institutions that support them.

We explore differences in perceptions among stakeholders from public, private, civil and academic sectors. We then discuss the implications of these stakeholder perceptions for advancing sustainable land-use planning, policy and stewardship in the region. While a variety of definitions for sustainable land use exist, here we define sustainable land-use trajectories as land-use patterns that meet growing development, food, and fiber demands while sustaining regulating services and livelihoods (The World Bank, 2006). As elsewhere in the sustainable forest management literature, we operationalize this to mean land use that seeks to balance ecological, social, and economic concerns in order

to maintain resilience in coupled environmental and social systems (Robinson & Tinker, 1998; Salwasser, 1993; Swart, Raskin, & Robinson, 2004).

2. Methods

2.1. Stakeholder interviews

To explore how different local stakeholders conceptualize landscape change, we conducted semi-structured interviews with representatives with responsibilities related to land use and resource management, regional and town planning, agriculture, and conservation. Qualitative approaches such as semi-structured interviews allow for interaction and reflection, and to account for the context and cultural background of interviewees (Muhar et al., 2017). These approaches are also considered particularly useful when the aim is to prepare for decision-making in natural resource management contexts (Davies, Fisher, Dickson, Thrush, & Le Heron, 2015; Lynam, De Jong, Sheil, Kusumanto, & Evans, 2007), which was the intent here (the interviews were conducted as part of a broader project aiming to develop and analyse land-use scenarios for New England, see McBride et al., 2017).

A total of 57 interviews were conducted across government (18), nongovernmental organizations (19), universities (6), tribal (1), and private (12) sectors. Interviewees were drawn from across federal, state, and county/local government agencies, the private sector (e.g., forestry and real estate consultants), and the various foundations, organizations, conservation groups, and academic institutions with direct or indirect involvement in New England's land use and management sector (Table 1). They included individuals with titles such as county forester, land conservation director, town planner, real estate specialist, extension specialist, and environmental commissioner. Individuals were selected through purposive sampling (Sarantakos, 2012) based on their individual or organisational responsibility for, and knowledge related to, land-use planning in New England. A purposive peer referral sampling approach was used (i.e., 'snowballing') drawing on the knowledge and contacts of the project team and steering committee and targeting professionals whose perspectives were considered particularly valuable. The results were consolidated using stakeholder mapping and used to inform stakeholder selection for interviews, with the goal of engaging a diversity of participants who represent different constituencies in New England. This purposive sampling approach allows for gaining an in-depth understanding of interviewee perspectives but does not permit making generalizations to a wider population (Creswell & Clark, 2007).

Interviews were conducted over the course of 2014–2015 and generally lasted between 30 min and 1 h. The interviews were conducted by three members of the project team, all of whom had prior experience with conducting phone interviews. Interview transcripts were recorded verbatim by interviewers. An interview script was developed and tested and stakeholders were randomly assigned to interviewers to help minimize any interviewer effects. A total of 30 interviews were conducted in the first round. After this a midway review was held to reassess the need for any changes to the interview protocol, and to update the results of the stakeholder mapping based on the recommendations of the first round interviewees.

The interviews used open-ended direct questions structured around a narrative framework to elicit perceptions of the land-use changes taking place, the drivers and impacts of these changes, and envisioned challenges and opportunities for the future of the New England landscape. The interview questions were developed by the project team in response to perspectives and feedback received at an initial project scoping meeting that brought together 35 researchers and stakeholders from across New England to discuss issues related to achieving sustainable land-use policy, planning, and stewardship in the region (see McBride et al., 2017 for more details). Questions were developed with the objectives of encouraging individual perspectives and concerns from respondents to help understand: how stakeholders perceive their work and role in relation to land use and forests in New England, their perspectives about how New England is changing and why, how they envision New England in the future and why, what changes were of most concern, and what opportunities or decisions that are coming up in the future that they need information for (see Appendix 1 for the full set of interview questions and protocol).

2.2. Qualitative analysis

Interviews were transcribed and responses were analysed using qualitative content analysis (Creswell & Clark, 2007). We used a modified grounded theory approach to identify key themes and ideas that emerged from the perspectives of stakeholders in relation to perceived challenges and opportunities for promoting sustainable land-use trajectories amidst conflicting priorities (Corbin & Strauss, 2014). Grounded theory analysis is a qualitative method used to systematically analyse large bodies of text (Corbin & Strauss, 2014), or in our case, the transcriptions of interviewees' responses to our questions. Our approach combined both open and selective coding methods and was completed using the NVivo 11 coding software (QSR International Pty Ltd, 2016). Transcripts were coded line-by-line to identify the different themes raised by each stakeholder. Following this open coding stage, selective coding was used to integrate these themes and establish connections between individual themes and central issues, with multiple coding rounds required to arrive the final set of themes and overarching categories, which were then utilized to re-interpret the data (Flick, 2006; Saldaña, 2009). The final result was a set of themes (codes) organized into three overarching groups: new or continued pressures driving land-use change, barriers inhibiting the ability of the New England landscape and inhabitants to adapt to change and opportunities for achieving sustainable land use.

Themes resulting from discussions at the initial scoping project meeting and subsequent informal stakeholder consultations over the months that followed served as an important means of triangulation. The output collected from six one-day scenario development workshops held in each of the New England states served as a second source of triangulation (a total of 128 stakeholders attended workshops, with approximately 20–25 stakeholders at each). Question three, and a

Table 1
Stakeholder subfield group classifications and group size (n).

Subfield	n	Description and/or examples
Conservation	16	Conservation NGO employees (e.g., Land trusts); a few government employees
Forestry & parks	8	Predominantly state government employees with responsibilities related to forest, parks and/or recreation
Forestry	8	Predominantly business employees or forestry consultants, e.g., timber and forestry management companies
Urban forestry	2	Urban forestry coordinators in government and NGOs
Agriculture	3	Individuals with responsibilities related to agriculture, e.g., regional food solution networks, natural resource management
Town planning	3	Town planners, planning consultants, Department of planning employees
Land investors	2	Business sector employees working in industries such as real estate and land development
Economic development	2	Employees from organizations aiming to promote regional community planning and economic development
Other	13	Individuals working across domains such as environmental health, tribal concerns, and public policy

ARTICLE IN PRESS

modified version of question four from the interview protocol (see Appendix 1) were incorporated as part of orientation exercises for the six workshops, and asked stakeholders to write individually and then discuss with others their perspectives on the future for New England, and the drivers of change that might shape how the region changes over the next 50 years (3 of the 57 stakeholders interviewed were also attendees at the initial codesign workshop, and 16 also attended one of the scenario elicitation workshops). The same purposive sampling approach used for the interviews was used to inform participation in both the scoping meeting and scenario elicitation workshops.

To gain insight into response patterns from stakeholders and why similar or different codes were being raised, we also calculated code *coverage*, the number of stakeholders who mentioned a particular code at least once during their interview, by state and sector affiliation. As many of the differences in perspectives appeared to be tied to the stakeholders' work focus and experiences in relation to land use in New England, the choice was also made to calculate coverage based on field of work.

Coverage for each code by participants' field of work was calculated based on a classification of their professional background and experience into one of eight subfields (e.g., conservation, forestry, town planning). Field of work classification was performed using information on their organizational affiliation(s), and responses to the initial interview question 'What work have you been doing recently related to land use and forests in New England?' (Table 1). Using responses to this question as well as current organizational affiliation was found to be important since many stakeholders were found to work for different organizations but in a similar capacity, and with similar backgrounds, training (and thus perspectives). For example, one stakeholder who worked for a utility company, had a background in forest management and was primarily responsible for the company's forestry and watershed protection efforts.

Due to a concentration of interviewees from conservation and forestry related fields, a number of the resulting subfield groups (e.g., agriculture, town planning) contained responses from only a small number of interviewees. However, we still report on perspectives for these groups to provide some insight into possible differences between their views and those of individuals from primarily conservation and forestry related backgrounds. This means that the themes and coverage rates we report for these subfields are suggestive at best, being much more subject to the individuals being interviewed and thus less appropriate for extrapolation to that sector as a whole. Only subfields with two or more individuals are reported on here, leaving 13 individuals for which no other stakeholders had similar enough backgrounds to allow for classification together (e.g., a tribal representative, an environmental health-focused NGO professional, and a public policy academic). In addition, the nature of our interview methodology (i.e., with stakeholders not prompted explicitly on each topic or code), means that interviewees that failed to comment on a particular topic must not be assumed to view it as unimportant, or in disagreement with it.

3. Results

3.1. Major themes

Coding participants' responses revealed sixteen major categories of challenges (Fig. 1). Of these sixteen identified challenges, we found they could be further classified into (i) *pressures*: new or continued pressures driving change in the New England socio-ecological system (Table 2), and (ii) *barriers*: concerns about existing structural and social barriers that hinder adapting to change (Table 3). Concerns about climate change impacts ranked highest (a category which included discussion of changes in climatic conditions, secondary impacts on land use, and climate adaptation planning) across all states, sectors and affiliations. However, this was at least in part the result of including a

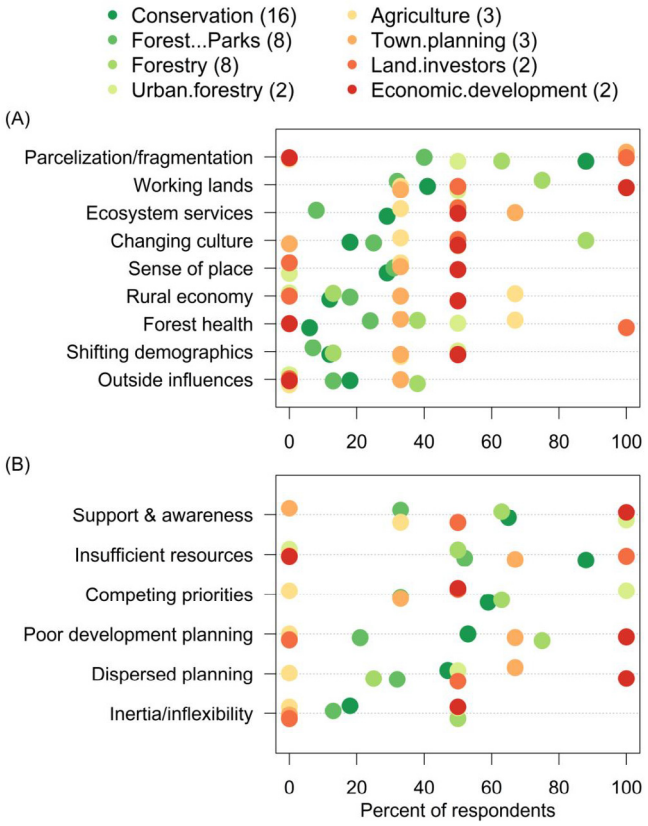

Fig. 1. Coverage of the major themes broken down by stakeholder subfield. Panels shows the percentage of stakeholders in each subfield who mentioned each category of (A) pressure, and (B) barrier at least once during their interview. See Tables 2 and 3 for additional descriptions of each theme. Within the legend, the number of interviewees (n) within each stakeholder group is shown in parentheses. Since the number of stakeholders contributing opinions for 5 of the 8 illustrated subfields is small ($n \leq 3$), these results must be viewed as suggestive only and do not necessarily provide a balanced representation of perspectives in each subfield (refer to Table 1 for a more detailed description of each subfield).

question specifically prompting interviewees to consider how climate change may impact land use, and thus we do not list it in Table 2 or Fig. 1. The need for (and frequent lack of) social, political and stakeholder support for any environmental management was the second most frequently cited challenge (65% of participants), and most frequently cited *barrier* to change. As climate change concerns were prompted by a specific question, the need for stakeholder support for environmental management could be considered the most important concern of interviewees. Aside from climate change, other frequently cited drivers of change included ongoing parcelization and fragmentation of forested land, the economic viability of working lands (i.e., lands set aside for conservation, forestry or agriculture), and changing sociocultural preferences and population demographics (Table 2). Other frequently cited barriers to change included insufficient resources to support environmental management, inadequate land-use regulation, and the dispersed planning context in which many of the most influential land-use decisions are made at the community or municipal level (Table 3). Brief snapshots highlighting key concerns or noticeable differences across sector and state are reported below, and Fig. 1 shows differences in the coverage of concerns reported across the seven identified stakeholder work and experience subfields (i.e., Table 1), though given the small subfield group sizes ($n \leq 3$) in most instances, these results are only suggestive and do not provide a representative account of perspectives for that subfield.

ARTICLE IN PRESS

Table 2
Stakeholder identified themes concerning new or continued pressures driving change across the New England landscape.

Name	Description	Example quotes
Parcelization/ fragmentation	Ongoing parcelization and fragmentation of land	"More development and forest fragmentation as population grows." "Large contiguous forest blocks are important and threatened"
Working lands	Reduced incentives or lack of support and/or no longer economically viable	"Drivers for development – the only hope for getting it right is that we value forests and that we make land use decisions through a process that includes forest values as a criterion." "Less political support for real property taxation incentives – like Current Use, Chapter 61" "As population centers become more urban, state legislatures have less support"
Ecosystem services	Ecosystem service provision – will they be able to be maintained, can adequate incentives be provided?	"Has to be a fairly big change in the way we price carbon…a flat carbon tax would drive this, applied across the board to all fuels, provide a clear simple and effective incentive and price signal for people to shift from fossil based fuels to renewables. That would be the single biggest driver" "What's really interesting about it is they don't understand that most landowners love their land. Ways to maintain their land cost effectively especially with massive inter-generational transfer. If society was willing to pay for ecosystem services people would be willing to do an even better job"
Landowner culture	Changing or reduced culture of ownership and of stewardship of the land	"The very large parcels are owned by people who are retired and near end of life. As the pass the land on, there is going to be pressure for land to be parcelized and sold." "…within a culture that was understanding – of the land, from the land; those people are going away and replaced by people not from a land-based culture. For the first time we are entering a world of more scarcity and a culture unaccustomed to working with the land" "Decreasing social acceptance of forestry in rural lands owned for amenity purposes" "The fragmentation and shifting culture of who owns land and how use is perceived is going to chip away at forest management and all that comes from that – see that trend continuing. All the policy and public money in the world unlikely to have an impact on that" "Average age of forestland owner is retirement age and older – at risk of having forest parcelized and developed in a way that we will lose ecosystem services and that will impact our resilience/adaptation – flooding, water quality"
Sense of place	Potential for the 'character of the land' to be lost. I.e., will the state have to change away from what inhabitant love about it?	"Loss of jobs – way of live – loss of longstanding part of our history; the opportunity to have an element of the economy – diversified not all tech and health care – actually have people making something" "Loss of fundamental connection to the environment that is an important part of our human existence. People in cities yearn for that. There is an element of a loss of our social identity that occurs if we are not growing stuff, managing stuff, harvesting stuff in nature"
Rural economy	Economic future for rural areas, particularly in northern New England. Will working lands (conservation, forestry, agriculture) continue to be a driving force for state economy?	"Are smaller villages able to sustain themselves economically and be neat places to be, or is it going to be declining?" "I wonder about small towns capacity to deal with change. I think a lot about whether people in very rural areas will want to remain in those rural areas or will they want to be in areas where you can walk to the grocery store and have live internet access"
Forest health	Deterioration or change of forest health and/or farmlands from introduced pests and pathogens and climate change impacts	"Will we see species changes, other insect and disease problems that we'll have to deal with" "As temp continues to rise invasives will be growing problem with declining forest health. Depressed diversity, complexity, and ultimately reduced biological forest productivity. Given the track we are on"
Demographic change	Shifting demographics, values and cultures	"…given that baby boomers and millennials are favoring urban environments – in urban centers or areas with amenities. Public transit, walk to amenities" "Millennials want a place where there are walkable communities, housing with modern amenities, and access to public transportation. Some of those are consistent with historic effort to effort to conserve land and some are not"
Outside influences	Being at the mercy of global markets and geopolitics, to a degree. Can't plan around or overcome these influences	"Subject to larger economic forces, national or stock market, when both federal agencies and private philanthropy, have money to devote, when not, they do not, in large sense, biggest driver, the national economy, does it become severely stressed the national and global economy, we don't have control over"

ARTICLE IN PRESS

Table 3
Stakeholder identified themes concerning barriers inhibiting the ability of the New England landscape and inhabitants to adapt to change.

Challenges	Description	Example quotes
Support and awareness	The need for social, political and stakeholder support for any action or change	"One big issue is lack of funding sort of tied with lack of public awareness" "Primary driver is lack of support for conservation implementation. Planning is the easy part – the conservation community loves to approach problems with conservation planning. Doesn't require sustained effort. Lack of sustained support for conservation implementation." "If we want to do more land conservation there is a real lack of funding and that is a state and federal issue" "Constituency building is so important…in the end communities, states and regions that don't care, all of this work could unravel, it exists on fragile ground in terms of directional change, development pressures, but hand in hand with the strategies, multipart"
Insufficient resources	Always limited government funding for environmental management and conservation. Low priority	"Difficult having the resources to try to do this appropriately…live in a state that is pretty conservative funding wise. Always reducing. Fourth budget in a row we are reducing" "The issue is that states are broke, communities are broke and feds are trying to save money" "Most challenging: raising the money, always a big challenge, more politely – finding messages and projects that resonate with donors and funders."
Competing priorities	Land use planning often falls low on the priority list. In some cases competing directly with things like the economy, local livelihoods, or NIMBY concerns	"In Rhode Island we face legislation that is driven by developers, affordable housing, the legislation causes land to be developed needless, developers use it to get around conservation planning, that is particularly hurting us, some decision by legislation to amend, because formula can never be achieved. "Always development pressure, but it is going to crank up. Don't know that land protection capacity will match growing economy" "Need clear approach to developing those cities to keep character in Maine. Zoning changes, right here in Gorham, small town, rural, but because they are desperate for money and businesses to come in they have rezoned areas to let fast food chains come in. What people do to get development into an area"
Dispersed planning context	Communities and municipal planners have high degree of influence, but often high turnover and lack of education. Lack of appreciation of 'bigger picture' and how their decisions play out across the region	"Biggest decision are the decisions made at the local government level to allow development and subdivision level. The key decision makers remain local governments and they don't have the incentives and sufficiently broad view to take into account the broader values of the landscape." "Pattern of development depends on community, so local boundaries and towns, each town has its own process. Some are doing a really good job with smart growth and recreation and forestry and other towns are all about development." "LU law protects against large scale development. Not small, incremental development – that is up to communities and most don't put appropriate regulations in"
Poor development planning	Poor planning leading to sprawling, unclustered development. Often the result of inadequate or perverse land use regulation	"Not so much in Northern NE, but in Southern NE there is a huge development challenge. Poor planning is a problem throughout the region. More of an issue in Northern New England. Distinction south and north. Bad development in southern NH and ME." "Sadly, worry that the landscape will lose forest because pop will be spread out. 169 municipalities in CT. Planners are really not planning, they are just thinking if they put some condo – tied to developers"
Inertia/inflexibility	Concerns over the need to update existing practices to account for changing circumstances, e.g., climate change adaptation. Decisions tend to be responsive rather than proactive	"People tend to be conservative if the town has always done something in one way even though development pressures of influence may have changed. Been to town meetings." "I wonder about small towns capacity to deal with change." "The historical connection between state and forest industry that is no longer as relevant as it might once have been. As a result there are a lot of exceptions in the law for forestry"

3.2. Sector differences

There was general agreement with regard to the type and priority of barriers identified across sectors. Stakeholders employed within the NGO and government sector tended to align most closely in their responses, while business and university affiliated individuals provided more contrasting perspectives. Differences in opinions or priorities could be mostly attributed to differences in responsibilities in their line of work. For example, both NGO (84%) and government (77%) employees were particularly concerned about insufficient resources and declining government funds, while this was a challenge that was much less frequently raised by individuals from the business (33%) and university sectors (17%). Other top-cited issues according to NGO and government employees were the need for support and awareness, and for smart growth versus unplanned development, concerns about parcelization and fragmentation of lands and the challenge of operating alongside competing demands (e.g., the economy, local livelihoods) which often take priority over conservation and forest management concerns. NGO employees were most likely to talk about the need for fostering landscape resilience and for moving towards a more holistic approach to landscape management.

Government employees raised similar issues in terms of concerns

ARTICLE IN PRESS

about maintaining adequate ecosystem service provision, and the changing culture of land ownership coupled with the potential loss of character of the land. The top concerns raised by business employees overlapped with many of those from NGO and government, and the most frequently raised issues were those related to the reduced economic viability of timber lands and the lack of proactive planning. As only six university employees were interviewed, their response patterns were more reflective of their particular field of research (e.g., environmental economics, public policy) though notable differences to other groups included a lack of mention of more operational-based concerns such as funding limitations and the dispersed New England planning context.

3.3. State differences

Despite broadly similar sets of concerns, differences in priorities among states were also evident, and reflected the distinct social, economic and political cultures of each state. In general, development pressures and inadequate conservation resources were viewed as some of the most pressing concerns for the more populous states in southern New England, including Connecticut, Massachusetts and Rhode Island; while concerns for stakeholders from the northern states of Vermont, Maine and New Hampshire were more reflective of those states' greater dependence on natural resource economies.

In Connecticut, stakeholders were particularly concerned about the declining availability of resources for conservation and about managing for climate change, often in relation to a possible increase in climate-induced migration. Concerns around a need for greater efforts to increase public engagement and awareness around environmental issues were raised based on perceptions of competing priorities and a reduced culture for land stewardship and protection relative to that present in other states:

> *"Most challenging is bureaucracy and constant struggle for both state and federal funding." (Government employee, CT)*

Massachusetts stakeholders raised similar concerns about the need for greater support and awareness around environmental management issues. These concerns were often voiced in relation to the importance of better recognizing and incentivizing the public good benefits that the state's privately owned forestlands provide:

> *"Recognition of value that forest provides or monetization of value of forest provides. Without that recognition forest becomes more of an obstacle to development." (Private sector employee, MA)*

In line with the concern about recognizing the value that forests provide, maintaining adequate ecosystem service provision was another strongly emerging Massachusetts state theme, as were concerns about proactively managing the state's ongoing development in a way that would promote concentrated 'green' urban development and help minimize fragmentation and sprawl.

Rhode Island stakeholders' concerns also reflected a similar set of themes, including frequent comments on the insufficient resources available, the challenge of maintaining support for conservation and forest management, and a need to promote smart growth to manage the growing development pressure.

> *"Think if things continue as they are in Rhode Island…the landscape will be more fragmented, more sprawling development chopping up farms and forests, we will lose more of the character that everyone loves as the state and landscape." (NGO employee, RI)*

They were also particularly mindful of climate change impacts and the need for immediate action in the coastal areas of Rhode Island. Their comments regarding climate change action were typically more positive that those of stakeholders from other states and reflected the fact that the need for adaptive climate action has been embraced by the state and local governments, with several stakeholders explicitly referencing the 2014 Resilient Rhode Island Act that gives government agencies the right to designate resources towards addressing climate change. This contrasted with the comments of stakeholders from the other New England states who typically viewed climate change as remaining either ignored or yet to catalyse any meaningful adaptive response.

> *"Rhode Island in particular has paid a lot of attention to this [climate change]. So many historic towns, right on the water. Jack up buildings, build barrier. Climate change is expected to have more tropical thunderstorms, at the same time that we are having faster pace of rising waters. Rhode Island is extremely vulnerable." (Town planner, RI)*

In contrast, for the northern New England states stakeholders framed their concerns about the loss of forests in terms of anticipated changes in ownership and the incentives available to support working forests. Vermont stakeholders, for example, were particularly concerned about changing patterns of landownership, the culture of the land ('what it means to be Vermont'), and the reduced economic viability of working forestry lands. Other frequently raised concerns included the impacts of parcelization and fragmentation, and how to adequately plan for these pressures when the most impactful land-use regulatory decisions are made at the local town level:

> *"While Vermont prides itself in strong land-use law and land ethic, the land ethic is not reflected in local zoning so towns have incentive to allow subdivision. Many towns have no zoning." (Government employee, VT)*

New Hampshire and Maine stakeholders voiced similar sets of concerns about the reduced economic viability of forestry lands amidst larger concerns about the ongoing viability of the rural economy and the future for northern rural towns, many of which are already depopulating in the face of economic decline:

> *"My concern is that the economic value that allows people to keep their land forested will go away." (Government employee, NH)*

Unless that brings a lot more population to the more rural areas, I think we will continue to see a thinning out of more rural areas and more dense development in rural centers.

> *"I see a continuing depopulation of rural landscape unless there is a turnaround in agriculture, forestry, ecotourism and ecosystems services." (University employee, ME)*

In addition, New Hampshire stakeholders highlighted the inadequacies of existing land use regulation, and their concerns about the uncontrollable impact that outside influences (e.g., economic markets, geopolitics) could have on the states' economic and development trends. For Maine, where stakeholders were mostly drawn from the more developed southern regions of the state, they also often commented on a greater need to respond to society's changing preferences, particularly in terms of an increased desire for urban living. The position of the current Maine governor towards the environment—favouring economic development over environmental concerns—also led many stakeholders to raise concerns about the future for public lands in Maine and the problems associated with operating in an environment of political hostility.

3.4. Opportunities for promoting sustainable land use

In addition to their concerns about future land use in New England, stakeholders also described opportunities for overcoming some of the barriers to achieving sustainable land use (Table 4). Some stakeholders offered specific strategies that could be adopted, but most of the identified codes were more speculative in nature, voiced in terms of areas where improvement was considered important. In response to the perceived need for greater awareness and support for environmental management, many of these opportunities centered on raising awareness and fostering value for nature in landowners and the public, often

ARTICLE IN PRESS

Table 4
Stakeholder identified opportunities for achieving sustainable land use.

Name	Description	Example quotes
Raising awareness	Raising awareness and fostering value for nature to counter the potential for a greater distancing from nature as rural livelihoods decline	"Kids from cities getting out to watersheds more and learning more about the land that makes them who they are." "…more up to date more public education about the places where we live and environment" "If you can describe the benefits of protecting those forest and rivers and valleys and put it in terms of the benefits for tourism and working forests, people appreciate that. The flooding that happened added to that. To the extent that we protect those landscapes there is a huge benefit to protecting assets from flood impacts"
Greening cities	Promoting green urban centres and well-planned, condensed, and low impact development was seen as providing opportunities to allow wildlands to remain wild and condense the expected development around existing cities, while also enhancing liveability and connection with nature	"Land conservation done well in the state will not only provide open space for recreation, ecosystem services, it will also in some ways help to channel development to those areas that are more suitable for development and maybe help to promote more low-impact development in what are already more densely populated areas. Take large unfragmented chunks and keep them that way – push people to do development elsewhere; also produces valuable and attractive lands close enough to where we want people to settle in a more compact, low impact approach to development"
Holistic planning and partnerships	Adopting a holistic approach to planning, e.g., combining conservation aims with other aims through partnerships as a means to overcome the limited funding and support for traditional land protection and environmental action	"I think it comes back to this holistic response and the extent to which we can work together at multiple scales to protect ecosystem services at watershed scale"
Town planning	Promoting more proactive town planning, particularly via promoting awareness and/or learning from those towns where good practices are already in place	"Rubber meets the road at the state level, but more specifically at community level. Landscape scale conservation is a bit of a misnomber. In my mind landscape conservation means coordinated implementation. To what extent can those components be aligned with similar landscape vision"
Landowner incentives	Updating older policies (e.g., in relation to landowners) to better reflect current and future generations of land owners and the rural population	"Create incentives to make it more affordable to develop in existing communities – so growth happens where we want it to be" "Very difficult to create easements to shape forest practices. My view is that programs such as carbon credits are the most effective way to pay for older age classes and to continue to thoughtfully secure ecological reserves with willing landowners which would ensure older growth"
Ecosystem services	New technologies and frameworks for valuing ecosystem services	"Drivers for development – the only hope for getting it right is that we value forests and that we make land use decisions through a process that includes forest values as a criterion" "If we can make a good case that forests are part of solution, carbon sequestration in forests or replanting areas that have been deforested, big push to put trees in cities, is there a way to persuade the general public that trees have something to do with improving quality of life in the face of changing climate"

amidst concerns of a growing disconnect between a population that now resides mostly in urban areas and nature. Seen as equally important was taking steps to promote condensed, low impact rural and urban development and greener cities: these were viewed as a way to avoid excessive sprawl and fragmentation, thereby allowing wildlands to remain wild while enhancing liveability and connection with nature for city inhabitants. Resource professionals viewed increasingly dense cities as a one part of the solution to suburban sprawl, though in doing so were mindful of the potential for increased disconnectedness from open and natural places for city inhabitants as an issue that effective future planning will need to find a way to reconcile.

> *"Many environmentalists see competition of money for cities or rural areas, but there needs to be a broader view. Those values of improving cities will also enhance our rural areas by keeping them rural." (Government employee, RI).*

Continuing an existing trend of aligning conservation aims with other objectives through partnerships was seen as an important strategy for in helping to overcome the limited funding and support for traditional land protection:

> *"Exciting part of it is partners and collaborating, not having to do it alone, leveraging partnerships. Ability to work with both traditional and non-traditional partners to promote conservation use of forest resources. Builds from grassroots up" (NGO employee, RI)*

Similarly, revising existing policies and incentives to better reflect current and future trends in private land ownership was seen as key to promoting a culture of stewardship and continued land management and conservation. Central to this was the idea of recognising and harnessing the many nonmonetary benefits that family forest owners derive from their land and designing new policies and networks that move beyond providing basic monetary incentives incentives (Klosowski, Stevens, Kittredge, & Dennis, 2001; e.g., Kilgore, Greene, Jacobson, Straka, & Daniels, 2007; Mayer & Tikka, 2006), for example by fostering engagement and support networks:

> *"…not just policy, but relationships, programs, and the like to help land owners preserve/conserve their land." (Private sector employee, MA)*
>
> *"….engagement between a woodland owner and woodlands…these incentive programs, support for federal programs, help unengaged get engaged. Cultural engagement has to be huge, why we value these as a whole, before we can get to that [sustainable] future" (NGO employee, CT)*

Developing approaches to support more proactive local planning efforts, for example, via learning and sharing of strategies across towns and providing a more regional perspective on the implications of individual town decisions was seen a valuable way to enhance existing local planning efforts. This was also in recognition of the influence that

ARTICLE IN PRESS

local land-use laws have on development patterns and the limitations with existing local planning regulations and structures in many of New England's towns and municipalities:

> *"Pattern of development depends on community, so local boundaries and towns, each town has its own process. Some are doing a really good job with smart growth and recreation and forestry and other towns are all about development." (Government employee, VT)*

Finally, many suggestions relating to the development of new frameworks for valuing ecosystem services were put forward as a way of attaching greater value to land protection and overcoming the existing lack of incentivizes available for supporting private land stewardship:

> *"Nationally, we have to begin to pay landowners big and small for the services they provide…I think it is critical that we recognize that CO_2 sequestration, water quality, air quality, habitat are vital products. We can price them now and forestlands ought to be compensated for that. Right now, those products are basically unpriced and landowners donate that. Sooner or later we need to move toward a system of recognition and compensation." (University employee, ME)*

4. Discussion

In landscapes dominated by private family forest owners, management efforts are challenged by the need to coordinate land-use decisions across thousands of individual private forest landowners (Odum, 1982; Theobald et al., 2000). This has raised concerns about the possibility of ensuring sustainable land use in the face of shifting environmental and socio-economic conditions, including changing ownership patterns and landowner demographics, increased forest parcelization and development pressures (Gobster et al., 2004; Stein et al., 2012). In this paper we asked the resource management professionals responsible for assisting private landowners with preserving their land for their perspectives on the future of New England and the prospects for moving towards more sustainable land-use practices. These professionals experience first-hand the changing social and ecological landscape and we sought to understand their views on existing approaches to support private land conservation in New England and whether they are perceived as adequate for achieving sustainable land-use trajectories.

4.1. Understanding stakeholder concerns

The results of the resource management professionals' interviews suggest that they view the existing institutional structures and efforts to manage New England's forested land as unsustainable, particularly when coupled with pressures from population growth, increasing development pressures, shifting cultures of land ownership and limited financial and public support. Their concerns also highlight structural and social barriers that are hindering effective adaptation to these pressures, including insufficient funding, a dispersed planning context, inadequate regulation, and planning that fails to sufficiently consider the broader regional context. At a higher level these concerns reflect a landscape in transition, with uncertainty present regarding the impact that a reduced ability for landowners to derive market values from their land will have on the role that privately owned forestland will play in the future for maintaining ecosystem services and wildlife, supporting livelihoods, suppling wood products, and providing recreational opportunities (Gobster et al., 2004; Morzillo et al., 2015).

These themes and drivers of change considered to be of particular concern by our interviewees resonate closely with many of the existing themes in the wider private woodland owner literature. For example, parcelization has been identified as an important concern, as have the dramatic changes that parcelization is considered to drive (Butler et al., 2016; Gustafson and Loehle, 2006; Mehmood and Zhang, 2001; Stein et al., 2005; Vickery, Germain, & Bevilacqua, 2009), such as additional development pressures and new ownership patterns across the landscape, each of which are viewed as negatively impacting forest health, timber-based economies, and local communities (Hatcher, Straka, & Greene, 2013; Stein et al., 2012). Similarly, a considerable amount of research exists around the topics of land transfer decisions for family forest owners (e.g., Creighton, Blatner, & Carroll, 2016; Markowski-Lindsay, Catanzaro, Milman, & Kittredge, 2016) and regarding the changing culture of landownership that includes fewer landowners having interest in forest management activities (Markowski-Lindsay et al., 2018). Concerns about inadequate local planning and zoning and insufficient resources and declining government funds are also common themes in the family forest literature, though with no easy solutions emerging. Sagor et al. (2014), for example, who reviewed the status of extension forestry in the US, noted that landowner assistance funding sources have transitioned from relatively stable base funding to short-term competitive funding, with cuts in base funding from state and federal resources resulting in reduced personal and capacity.

Interestingly, our findings also align quite well with the outputs from other research exploring the perspectives of resource managers operating in predominantly privately owned landscapes (e.g., Gobster et al., 2004; Kilgore and Snyder, 2016; Knoot et al., 2009; Miller, Snyder, & Kilgore, 2015; Rouleau et al., 2016). While many of these studies citied focused particularly on parcelization and its drivers and impacts, many similarities in the drivers and concerns identified by stakeholder still arose. Knoot et al. (2009), for example, identified more frequent ownership changes, increases in exurban residential development, forest parcelization and changes in landowner attitudes and awareness (placing greater importance on nontimber attributes of forestland and less familiarity with and knowledgeable about their land) as the issues most frequently raised as concerning by stakeholders. And Kilgore and Snyder (2016) in surveying field-based public natural resource managers in the Lake States (MI, MN, WI) regarding their perspectives on private forest land parcelization found that public land management agency employees did not believe they currently have the necessary tools to prevent parcelization—and its follow-on impacts—from occurring.

4.2. Differences across sectors and subfields

Sustainability is a value-based concept, and diverse perspectives are therefore necessary in building an understanding of what a sustainable land-use future for New England might look like (Shindler & Cramer, 1999). In our interviews the responses were broadly consistent across stakeholder groups, but there was also variation across different sectors, states, and subfields. This helped provide a useful lens through which to understand the influence of background, location, and occupation on how stakeholders perceived the challenges associated with achieving sustainable land use in New England. It was clear that the NGO employees and lawmakers had a more practical view of limitations and barriers, rooted in funding and political capacity, whereas the academics and private sector employees offered a more removed perspective. There were also varied opinions about the degree to which a natural resource-based economy—potentially driven by new ways of recognizing the contributions of privately owned land—might represent the best way forward, with northern New England stakeholders tending to be more inclined to view the former as the case more so than those from southern New England. Consulting with stakeholders across multiple sectors and states therefore permitted a more comprehensive picture of where and how challenges to sustainable land use were being encountered and framed (but see the methodological limitations section for important caveats to this).

4.3. Opportunities for transitioning to sustainable land use

Crucially, many of the individuals interviewed have direct or indirect responsibilities for helping incentivize protection and

management of privately owned forests and noted the inadequacy of existing measures for countering the ongoing trend of parcelization and development as New England's population grows (Butler et al., 2012; Kittredge, 2004). Across sectors, they strongly believe that the available programs and governance systems are outdated and they do not believe they have the tools or ability to prevent the loss of New England's privately owned forests to ongoing development.

In terms of perceived pathways forward, interviewees' suggestions regarding various strategies for improving land use seemed to be largely speculative rather than offering specific, concrete solutions. In this sense, one interpretation of our findings could be that interviewees are aware of pressures and challenges but struggle to offer more concrete solutions that go beyond echoing standard concerns regarding the need for more funding, improved regulatory and incentive programs and greater public awareness. Most of the identified areas for improvement, for example, are well-covered issues that still have yet to be satisfactorily resolved in New England, or in the family forest literature more generally (e.g., the need for 'smart' growth versus fragmented development and avoiding the parcelization and land development that often stems from intergenerational transfer; see Gobster et al. (2004) for examples of similiar response strategies from a much earlier paper). Stakeholders also seemed mindful of this in offering these suggestions: when they discussed funding limitations as a salient concern, for instance, this was usually with an awareness that the prospects for increased funding for land acquisition are probably limited.

4.4. Areas for improving upon existing polices and incentives

Many of the stakeholders noted the need to revise existing policies and incentives to better align with current and projected future trends in private land ownership demographics and motivations (Butler et al., 2016). In this regard, stakeholders' concerns reflect an acute awareness (also present in the wider private woodland owner literature) that these programs are unlikely to be providing the necessary reach and coverage to protect privately owned woodlands into the future. Identified problems include low enrollment rates (Butler et al., 2016; Kilgore et al., 2015; Miller, Snyder, & Kilgore, 2012; Rouleau et al., 2016), concerns over whether programs are truly effective at influencing landowner behaviour (Daniels, Kilgore, Jacobson, Greene, & Straka, 2010; Kilgore et al., 2007) and/or mitigating forest loss (Polyakov & Zhang, 2008), the fact that they cannot compete with the financial gains from development (Butler et al., 2012), and that they appear not to influence decisions about whether private woodland owners will sell or subdivide their forestland (Butler et al., 2014; Kilgore et al., 2015; Stein et al., 2009).

Low program enrollment rates have been attributed to a combination of a lack of awareness and lack of interest (Butler et al., 2016). Diversifying outreach efforts and broadening the suite of programs and assistance offered to landowners is therefore seen as an important part of expanding enrollment to new audiences. As our interviewees frequently referenced, the relevance of many programs focused on helping private forest owners manage their land and become more productive timber managers has decreased as private woodland owner motivations shift increasingly towards recreational and/or legacy objectives (Daniels et al., 2010; Ma, Butler, Kittredge, & Catanzaro, 2012; Rickenbach & Kittredge, 2009). Some of the specific suggestions raised by stakeholders for improving upon existing programs that are echoed in the private woodland owner literature include (i) encouraging greater peer-to-peer networking to help outreach efforts, increase stewardship culture and support multi-property and landscape-scale management programs (e.g., (Butler et al., 2007; Duff, Zedler, Barzen, & Knuteson, 2017; Fischer, Klooster, & Cirhigiri, 2018; Kittredge et al., 2013), (ii) working to enhance legacy estate planning assistance to help land avoid being developed or sold as a result of intergenerational transfer (Creighton et al., 2016; Markowski-Lindsay et al., 2017; Stone & Tyrrell, 2012; Withrow-Robinson, Allred, Landgren, & Sisock, 2013), and (iii) investing further in the targeting of outreach and extension programs to better reach landowners based on increasingly diverse motivations and preferences (Ma et al., 2012; Metcalf, Gruver, Finley, & Luloff, 2015; Sagor et al., 2014).

Many of the stakeholders also raised landowner incentive programs that target modified conservation goals such as ecosystem services provision as an important potential avenue through which to incentivize landowners to maintain their forested land and derive compensation. Payment for ecosystem services (PES) schemes are often viewed as a way of supporting private forests and for enticing program participation from landowners who would not engage in typical forest management activities or programs (e.g., Knoot, Rickenbach, & Silbernagel, 2015). However, research examining landowner willingness to participate in PES type programs (e.g., Kelly, Gold, & Di Tommaso, 2017; Miller, Snyder, Kilgore, & Davenport, 2014) suggests that many of the program requirements that would need to be put in place to assure offset quality are barriers to landowner participation. Lengthy time commitments, withdrawal penalties, management plans, complex participation requirements, and low carbon prices have all been found to be viewed as deterrents by landowners (Dickinson, Stevens, Lindsay, & Kittredge, 2012; Kelly et al., 2017; Khanal et al., 2017). As with incentive programs more generally, landowners appear to be resistant to long contracts and a sense of losing their ability to manage forests into the future without constraints (Fischer & Charnley, 2010; Kelly, Germain, & Mack, 2016; Wade & Moseley, 2011). As such, whether and in what form it will be possible to balance landowners preferences with the attributes requirements for a viable carbon program sequestrations remains an open question (Knoot et al., 2015).

4.5. Reconciling competing demands

One of the apparent findings from our work is the idea of competing paths forward that will need to be reconciled. For example, between concerns regarding the viability of rural economies and pushing people towards greener cities (e.g., Alig, Kline, & Lichtenstein, 2004; Bliss, 2003; Stein et al., 2012), and between the idea of encouraging growth in urban centers to prevent further sprawl and parcelization even though dense cities can often result in a greater disconnectedness from open and natural places for inhabitants (e.g., Gallemore, Munroe, & van Berkel, 2018; Neuman, 2005; Webb et al., 2018). Effective future planning will need to resolve these differences. Designing 'green cities' tended to be viewed by stakeholders as a way to blend density and liveability by providing opportunities for meaningful interactions with the natural world while reducing demand for development in rural areas (e.g., Bibri & Krogstie, 2017; Cilliers, Du Toit, Cilliers, Drewes, & Retief, 2014; Harper, Bloniarz, DeStefano, & Nicolson, 2017). However, while appealing in principle, in practice sustainable urban planning initiatives face many of the same challenges as other areas of land-use planning (Campbell, 1996; Neuman, 2005) including competing demands, lack of funding, and planning that fails to adequately consider the surrounding ecosystem, the community, and regional context (Bibri & Krogstie, 2017; Neuman, 2005; Webb et al., 2018).

4.6. Methodological limitations

The results we present here are an attempt to address a nuanced set of issues based on a limited sample and single research methodology and any conclusions must be understood as such. We employed an interview format combined with qualitative analysis to probe resource management professionals' perspectives regarding land-use change in New England, a methodology that has a number of important limitations. Firstly, while our purposive sampling approach was valuable in targeting professionals with a rich body of knowledge and experience it does not provide a representative sample and our results cannot be generalized beyond those who participated in the study. While we sought to interview stakeholders across all sectors relevant to land use,

ARTICLE IN PRESS

the fact that we were unable to interview many stakeholders who represent interests less sympathetic to sustainable land use and private land conservation (eg. real estate developers and recent woodland owners) is also likely to have introduced bias into our results. This is a common issue in transdisciplinary research (Pooley et al., 2014) and unfortunately means our results provide a likely biased perspective on challenges and opportunities for New England's land-use future, one in which the majority of interviewed stakeholders—even across sectors—viewed the goal of achieving sustainable land use as a priority. Further work with different stakeholder groups in New England, especially from underrepresented areas of expertise such as rural, economic and community development professionals and government officials working outside of conservation and land use, would thus provide a valuable counterpoint to this work and allow for exploration of the broader validity and relevance of our findings. Given the discussion involving green urban development and other urban issues, hearing from urban officials in various roles about the challenges they see for New England, for example, would also be a useful area for extension in future work.

Secondly, grounded theory analysis is a method that provides data depth and richness at the expense of generalizability. The individual researcher also plays a critical role in constructing and interpreting the data, and any findings are thus to some degree influenced by their particular worldview and biases (Bryant & Charmaz, 2007). Triangulation of data sources (different interviewees, workshop participants) and types (interviews, workshop observation and outputs) was carried out to help ensure trustworthiness of the data and findings, but the results of our grounded theory analysis should still not be considered to have emerged wholly from the data.

Finally, our one-hour phone interview format was coupled with a generalized question set and very broad topic. This did not really offer stakeholders the time to respond in depth and is likely to have been less conducive to eliciting more detailed and deeply considered responses. This may be at least one reason for the level of generality and lack of precision observed in some of our responses. A follow-up study that hones in more specifically on some of particular issues raised here would be one possible next step to take in response to this. Other possible concerns with the interviewees' responses are that data based on people's perceptions are subject to their subjectivity and reliant on participants' memories, and that single-shot interviews provide only a snapshot, failing to capture any shifts in perspectives over time. Despite these important limitations, we still believe this study provides important insights and compliments existing work in the literature.

5. Conclusion

Land-use decisions made today will influence the services and benefits provided by privately owned forests in the future. Exploring resource management perspectives as investigated in this article provided a means through which to understand the social and environmental complexities that underlie transitioning towards sustainable land use in New England. Our findings suggested that resource management professionals were acutely aware of the pressures and challenges faced but struggled to offer concrete suggestions to improve planning and policies. While it is important to note that our findings are based on participant perceptions, we found that the concerns and response strategies mentioned by interviewees closely paralleled the range of socio-cultural, regulatory, incentive, outreach and approaches currently being debated in the family forest owner literature. Many of the stakeholders' concerns stemmed from what they perceived as shifts in landowner values and culture regarding privately forested lands, and the potential for this to drive an increasing disconnect of people from nature and a decreased valuing for the maintenance of forested land. They viewed existing programs and governance systems as inadequate and in need of revising to better align with current and projected future trends in private land ownership demographics and motivations.

Despite their concerns, stakeholders also suggested a number of action pathways worth pursuing in helping to promote a sustainable family forest landscape in New England, including: (1) improving the targeting of polices to better meet the needs of the changing and increasingly diverse ownership body, (2) explore new methods of education and outreach to improve awareness of existing programs by rural and urban audiences, and (3) exploring new partnerships and establishing learning and support network across town, landowner, NGO and governmental spheres that will increase the likelihood of knowledge transfer and coordinated land-use decisions. However, given that our interviewees were predominately sympathetic to sustainable land use concerns, future efforts to engage stakeholders will benefit from more balance across the multiple domains involved, and greater representation of different or opposing perspectives to those largely reflected here. This is an important concern in terms of understanding and being able to generalize from the findings of our research.

Acknowledgements

This research was supported in part by the National Science Foundation Harvard Forest Long Term Ecological Research Program (Grant No. NSF-DEB 12-37491) and the Scenarios Society and Solutions Research Coordination Network (Grant No. NSF-DEB-13-38809). We thank Elisabetta Maino and Åsa Ode Sang for helpful comments on an earlier version of this manuscript. We are grateful to the many participating stakeholders for their time and engagement during the interview process.

A. Appendices

A.1. Interview protocol

A.1.1. OPENING SCRIPT

My name is [list researcher's name] from [firm's name]. On behalf of [xxxx], I am asking you to take part in a research study. I would like to interview you to learn more about your view of forest and land-use challenges and their consequences in [state]. The interview will last about 45 min.

The purpose of the research project is to work with professionals from across New England to develop alternative forest and land change scenarios for the region. We anticipate that the results will be useful to informing decisions about climate adaptation planning, public budgets for infrastructure and land protection, and conservation priority-setting. You can learn more about the project and sign-up for updates at the website: [xxxx]. The interviews will help us understand how diverse stakeholders view the future drivers, threats, and opportunities for the New England landscape.

As we go through the questions, I will type your answers. I may ask clarifying questions but will not engage in general conversation so as not to influence your responses, though there is time at the end for more discussion. I will keep the data I collect from this interview confidential, will not use any of your answers for personal attribution, and will not share your personal information with anyone outside the research team. Participation in this study is voluntary, so please tell me if you do not want to participate or if you would like to skip any questions.

Do you have any questions about the consent, research, or interview process before we begin?

If there are any questions I cannot answer, please contact [xxxx] at: [xxxx]

A.1.2. Questions

1. What work have you been doing recently related to land use and forests in New England?
2. What are the most exciting aspects of that work and what are the most challenging?

3. To help us develop alternative landscape futures, imagine you are standing on top of a mountain in 2065 in (state) and can see the entire state. How does the landscape look different from today?
4. What factors or events may have driven, or caused those changes? Please give specific examples.
5. Of the many possible impacts and benefits of a changing landscape, which are most important to you and why?
6. What major decisions do you anticipate in the coming years that will influence the outcomes that are important to you? Who makes those decisions? What factors are likely to influence those decision makers?
7. To what extent and how do you think climate change is altering land use in New England? How do you expect that will (or, might) change in the future?
8. *(Vermont only)*: What role has land conservation played in shaping the 2065 landscape you envisioned?

References

Alig, R. J., Kline, J. D., & Lichtenstein, M. (2004). Urbanization on the US landscape: Looking ahead in the 21st century. *Landscape and Urban Planning, 69*(2-3), 219–234.

Bibri, S. E., & Krogstie, J. (2017). Smart sustainable cities of the future: An extensive interdisciplinary literature review. *Sustainable Cities and Society, 31*, 183–212.

Bliss, J. C. (2003). Sustaining family forests in rural landscapes: Rationale, challenges, and an illustration from Oregon, USA. *Small-scale Forest Economics, Management and Policy, 2*(1), 1–8.

Bryant, A., & Charmaz, K. (2007). *The Sage handbook of grounded theory*. London: Sage Publications.

Butler, B. J., Catanzaro, P. F., Greene, J. L., Hewes, J. H., Kilgore, M. A., Kittredge, D. B., et al. (2012). Taxing family forest owners: Implications of federal and state policies in the United States. *Journal of Forestry, 110*(7), 371–380.

Butler, B., Hewes, J. H., Dickinson, B. J., Andrejczyk, K., Butler, S. M., & Markowski-Lindsay, M. (2016). *USDA Forest Service National Woodland Owner Survey: National, regional, and state statistics for family forest and woodland ownerships with 10+ acres, 2011–2013. Research bulletin NRS-99*. Northern Research Station, Newtown Square, PA: US Department of Agriculture, Forest Service.

Butler, B. J., Markowski-Lindsay, M., Snyder, S., Catanzaro, P., Kittredge, D. B., Andrejczyk, K., et al. (2014). Effectiveness of landowner assistance activities: An examination of the USDA Forest Service's Forest Stewardship Program. *Journal of Forestry, 112*(2), 187–197.

Butler, B. J., Tyrrell, M., Feinberg, G., VanManen, S., Wiseman, L., & Wallinger, S. (2007). Understanding and reaching family forest owners: Lessons from social marketing research. *Journal of Forestry, 105*(7), 348–357.

Butler, B. J. (2008). *Family forest owners of the United States*. Newtown Square, PA: USDA Forest Service, Northern Research Station.

Campbell, S. (1996). Green cities, growing cities, just cities? Urban planning and the contradictions of sustainable development. *Journal of the American Planning Association, 62*(3), 296–312.

Cilliers, S., Du Toit, M., Cilliers, J., Drewes, E., & Retief, F. (2014). Sustainable urban landscapes: South African perspectives on transdisciplinary possibilities. *Landscape and Urban Planning, 125*, 260–270.

Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Thousand Oaks, CA: Sage Publications.

Cowling, R. M., & Wilhelm-Rechmann, A. (2007). Social assessment as a key to conservation success. *Oryx, 41*(2), 135.

Creighton, J., Blatner, K. A., & Carroll, M. S. (2016). For the love of the land: Generational land transfer and the future of family forests in western Washington Statem, USA. *Small-scale forestry, 15*(1), 1–15.

Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*. London: Sage Publications.

D'Amato, A. W., Jokela, E. J., O'Hara, K. L., & Long, J. N. (2017). Silviculture in the United States: An amazing period of change over the past 30 years. *Journal of Forestry, 116*(1), 55–67.

Daigle, J. J., Utley, L., Chase, L. C., Kuentzel, W. F., & Brown, T. L. (2012). Does new large private landownership and their management priorities influence public access in the northern forest? *Journal of Forestry, 110*(2), 89–96.

D'Amato, A. W., Catanzaro, P. F., Damery, D. T., Kittredge, D. B., & Ferrare, K. A. (2010). Are family forest owners facing a future in which forest management is not enough? *Journal of Forestry, 108*(1), 32–38.

Daniels, S. E., Kilgore, M. A., Jacobson, M. G., Greene, J. L., & Straka, T. J. (2010). Examining the compatibility between forestry incentive programs in the US and the practice of sustainable forest management. *Forests, 1*(1), 49–64.

Davies, K. K., Fisher, K. T., Dickson, M. E., Thrush, S. F., & Le Heron, R. (2015). Improving ecosystem service frameworks to address wicked problems. *Ecology and Society, 20*(2), 37.

Dickinson, B. J., Stevens, T. H., Lindsay, M. M., & Kittredge, D. B. (2012). Estimated participation in US carbon sequestration programs: A study of NIPF landowners in Massachusetts. *Journal of Forest Economics, 18*(1), 36–46.

Drummond, M. A., & Loveland, T. R. (2010). Land-use pressure and a transition to forest-cover loss in the eastern United States. *BioScience, 60*(4), 286–298.

Duff, A. J., Zedler, P. H., Barzen, J. A., & Knuteson, D. L. (2017). The capacity-building stewardship model: Assessment of an agricultural network as a mechanism for improving regional agroecosystem sustainability. *Ecology and Society, 22*(1).

Farmer, J. R., Meretsky, V., Knapp, D., Chancellor, C., & Fischer, B. C. (2015). Why agree to a conservation easement? Understanding the decision of conservation easement granting. *Landscape and Urban Planning, 138*, 11–19.

Fischer, A. P., & Charnley, S. (2010). Social and cultural influences on management for carbon sequestration on US family forestlands: A literature synthesis. *International Journal of Forestry Research, 2010*, 960912.

Fischer, A. P., Klooster, A., & Cirhigiri, L. (2018). Cross-boundary cooperation for landscape management: Collective action and social exchange among individual private forest landowners. *Landscape and Urban Planning*.

Fitzsimons, J., Pulsford, I., & Wescott, G. (2013). Lessons from large-scale conservation networks in Australia. *Parks, 19*(115–125).

Flick, U. (2006). *An introduction to qualitative research*. London: Sage Publications.

Foster, D. R., Donahue, B. M., Kittredge, D. B., Lambert, K. F., Hunter, M. L., Hall, B. R., et al. (2010). *Wildlands and Woodlands: A vision for the New England landscape*. Petersham: Harvard University.

Foster, D. R., Lambert, K. F., Kittredge, D. B., Donahue, B., Hart, C. M., Labich, W., et al. (2017). *Wildlands and Woodlands, Farmlands and Communities: Broadening the vision for New England*. Cambridge: Harvard University.

Gallemore, C., Munroe, D., & van Berkel, D. (2018). Rural-to-urban migration and the geography of absentee non-industrial private forest ownership: A case from southeast Ohio. *Applied Geography, 96*, 141–152.

Gobster, P. H., Stewart, S. I., & Bengston, D. N. (2004). The social aspects of landscape change: Protecting open space under the pressure of development. *Landscape and Urban Planning, 69*(2), 149–151.

Guerrero, A. M., Mcallister, R. R., & Wilson, K. A. (2015). Achieving cross-scale collaboration for large scale conservation initiatives. *Conservation Letters, 8*(2), 107–117.

Gustafson, E. J., & Loehle, C. (2006). Effects of parcelization and land divestiture on forest sustainability in simulated forest landscapes. *Forest Ecology and Management, 236*(2–3), 305–314.

Harper, R. W., Bloniarz, D. V., DeStefano, S., & Nicolson, C. R. (2017). Urban forest management in New England: Towards a contemporary understanding of tree wardens in Massachusetts communities. *Arboricultural Journal, 39*(3), 162–178.

Hatcher, J. E., Straka, T. J., & Greene, J. L. (2013). The size of forest holding/parcelization problem in forestry: A literature review. *Resources, 2*(2), 39–57.

Huff, E. S., Leahy, J. E., Hiebeler, D., Weiskittel, A. R., & Noblet, C. L. (2015). An agent-based model of private woodland owner management behavior using social interactions, information flow, and peer-to-peer networks. *PloS One, 10*(11), e0142453.

Kelly, M. C., Germain, R. H., & Mack, S. A. (2016). Forest conservation programs and the landowners who prefer them: Profiling family forest owners in the New York City watershed. *Land Use Policy, 50*, 17–28.

Kelly, E. C., Gold, G. J., & Di Tommaso, J. (2017). The willingness of non-industrial private forest owners to enter California's carbon offset market. *Environmental Management, 60*(5), 882–895.

Khanal, P. N., Grebner, D. L., Munn, I. A., Grado, S. C., Grala, R. K., & Henderson, J. E. (2017). Evaluating non-industrial private forest landowner willingness to manage for forest carbon sequestration in the southern United States. *Forest Policy and Economics, 75*, 112–119.

Kilgore, M. A., Greene, J. L., Jacobson, M. G., Straka, T. J., & Daniels, S. E. (2007). The influence of financial incentive programs in promoting sustainable forestry on the nation's family forests. *Journal of Forestry, 105*(4), 184–191.

Kilgore, M. A., & Snyder, S. A. (2016). Lake States natural resource managers' perspectives on forest land parcelization and its implications for public land management. *Land Use Policy, 59*, 320–328.

Kilgore, M. A., Snyder, S. A., Eryilmaz, D., Markowski-Lindsay, M. A., Butler, B. J., Kittredge, D. B., et al. (2015). Assessing the relationship between different forms of landowner assistance and family forest owner behaviors and intentions. *Journal of Forestry, 113*(1), 12–19.

Kittredge, D. B. (2004). Extension/outreach implications for America's family forest owners. *Journal of Forestry, 102*(7), 15–18.

Kittredge, D. B. (2005). The cooperation of private forest owners on scales larger than one individual property: International examples and potential application in the United States. *Forest Policy and Economics, 7*(4), 671–688.

Kittredge, D. B., D'Amato, A. W., Catanzaro, P., Fish, J., & Butler, B. (2008). Estimating ownerships and parcels of nonindustrial private forestland in Massachusetts. *Northern Journal of Applied Forestry, 25*(2), 93–98.

Kittredge, D. B., Rickenbach, M. G., Knoot, T. G., Snellings, E., & Erazo, A. (2013). It's the network: How personal connections shape decisions about private forest use. *Northern Journal of Applied Forestry, 30*(2), 67–74.

Kittredge, D. B., & Thompson, J. R. (2016). Timber harvesting behaviour in Massachusetts, USA: Does price matter to private landowners? *Small-Scale Forestry, 15*(1), 93–108.

Kline, J. D., & Alig, R. J. (2005). Forestland development and private forestry with examples from Oregon (USA). *Forest Policy and Economics, 7*(5), 709–720.

Klosowski, R., Stevens, T., Kittredge, D., & Dennis, D. (2001). Economic incentives for coordinated management of forest land: A case study of southern New England. *Forest Policy and Economics, 2*(1), 29–38.

Knoot, T. G., Rickenbach, M., & Silbernagel, K. (2015). Payments for ecosystem services: Will a new hook net more active family forest owners? *Journal of Forestry, 113*(2), 210–218.

Knoot, T. G., Schulte, L. A., Grudens-Schuck, N., & Rickenbach, M. (2009). The changing social landscape in the Midwest: A boon for forestry and bust for oak? *Journal of Forestry, 107*(5), 260–266.

Lindhjem, H., & Mitani, Y. (2012). Forest owners' willingness to accept compensation for

ARTICLE IN PRESS

voluntary conservation: A contingent valuation approach. *Journal of Forest Economics, 18*(4), 290–302.
L'Roe, A. W., & Rissman, A. R. (2017). Changes in Wisconsin's large private forests, 1999–2015: Land ownership, conservation, and recreational access. *Society & Natural Resources, 30*(1), 63–78.
Labich, W. G., Hamin, E. M., & Record, S. (2013). Regional conservation partnerships in New England. *Journal of Forestry, 111*(5), 326–334.
Lynam, T., De Jong, W., Sheil, D., Kusumanto, T., & Evans, K. (2007). A review of tools for incorporating community knowledge, preferences, and values into decision making in natural resources management. *Ecology and Society, 12*(1), 5.
Ma, Z., Butler, B. J., Kittredge, D. B., & Catanzaro, P. (2012). Factors associated with landowner involvement in forest conservation programs in the US: Implications for policy design and outreach. *Land Use Policy, 29*(1), 53–61.
Markowski-Lindsay, M., Catanzaro, P., Bell, K., Kittredge, D., Leahy, J., Butler, B., et al. (2017). Estate planning as a forest stewardship tool: A study of family land ownerships in the northeastern US. *Forest Policy and Economics, 83*, 36–44.
Markowski-Lindsay, M., Catanzaro, P., Bell, K., Kittredge, D., Markowitz, E., Leahy, J., et al. (2018). In forest and intact: Designating future use of family-forest-owned land. *Journal of Forestry, 116*(4), 357–366.
Markowski-Lindsay, M., Catanzaro, P., Milman, A., & Kittredge, D. (2016). Understanding family forest land future ownership and use: Exploring conservation bequest motivations. *Small-scale Forestry, 15*(2), 241–256.
Mayer, A. L., & Tikka, P. M. (2006). Biodiversity conservation incentive programs for privately owned forests. *Environmental Science & Policy, 9*(7–8), 614–625.
McBride, M. F., Lambert, K. F., Huff, E. S., Theoharides, K. A., Field, P., & Thompson, J. R. (2017). Increasing the effectiveness of participatory scenario development through co-design. *Ecology and Society, 22*(3), 16.
Mehmood, S. R., & Zhang, D. (2001). Forest parcelization in the United States: A study of contributing factors. *Journal of Forestry, 99*(4), 30–34.
Metcalf, A. L., Gruver, J. B., Finley, J. C., & Luloff, A. (2015). Segmentation to focus outreach: Behavioral intentions of private forest landowners in Pennsylvania. *Journal of Forestry, 114*(4), 466–473.
Meyer, S. R., Cronan, C. S., Lilieholm, R. J., Johnson, M. L., & Foster, D. R. (2014). Land conservation in northern New England: Historic trends and alternative conservation futures. *Biological Conservation, 174*, 152–160.
Miller, K. A., Snyder, S. A., & Kilgore, M. A. (2012). An assessment of forest landowner interest in selling forest carbon credits in the Lake States, USA. *Forest Policy and Economics, 25*, 113–122.
Miller, K. A., Snyder, S. A., & Kilgore, M. A. (2015). State forestry agency perspectives on carbon management and carbon market assistance to family forest owners. *Journal of Forestry, 113*(4), 372–380.
Miller, K. A., Snyder, S. A., Kilgore, M. A., & Davenport, M. A. (2014). Family forest landowners' interest in forest carbon offset programs: Focus group findings from the Lake States, USA. *Environmental Management, 54*(6), 1399–1411.
Morzillo, A. T., Colocousis, C. R., Munroe, D. K., Bell, K. P., Martinuzzi, S., Van Berkel, D. B., et al. (2015). "Communities in the middle": Interactions between drivers of change and place-based characteristics in rural forest-based communities. *Journal of Rural Studies, 42*, 79–90.
Muhar, A., Raymond, C. M., van den Born, R. J. G., Bauer, N., Böck, K., Braito, M., et al. (2017). A model integrating social-cultural concepts of nature into frameworks of interaction between social and natural systems. *Journal of Environmental Planning and Management*, 1–22.
Neuman, M. (2005). The compact city fallacy. *Journal of Planning Education and Research, 25*(1), 11–26.
Odum, W. E. (1982). Environmental degradation and the tyranny of small decisions. *BioScience, 32*(9), 728–729.
Olofsson, P., Holden, C. E., Bullock, E. L., & Woodcock, C. E. (2016). Time series analysis of satellite data reveals continuous deforestation of New England since the 1980s. *Environmental Research Letters, 11*(6), 064002.
Polyakov, M., & Zhang, D. (2008). Property tax policy and land-use change. *Land Economics, 84*(3), 396–408.
Pooley, S. P., Mendelsohn, J. A., & Milner-Gulland, E. J. (2014). Hunting down the chimera of multiple disciplinarity in conservation science. *Conservation Biology, 28*(1), 22–32.
QSR International Pty Ltd (2016). Nvivo qualitative data analysis software. Version 11.
Quinn, J., & Wood, J. (2017). Application of a coupled human natural system framework to organize and frame challenges and opportunities for biodiversity conservation on private lands. *Ecology and Society, 22*(1), 39.
Rabotyagov, S. S., & Lin, S. (2013). Small forest landowner preferences for working forest conservation contract attributes: A case of Washington State, USA. *Journal of forest economics, 19*(3), 307–330.
Rickenbach, M., & Kittredge, D. B. (2009). Time and distance: Comparing motivations among forest landowners in New England, USA. *Small-scale Forestry, 8*(1), 95–108.
Robinson, J., & Tinker, J. (1998). Reconciling ecological, economic and social imperatives. In J. Schnurr, & S. Holtz (Eds.). *The cornerstone of development: Integrating environmental, social and economic policies*. Ottawa: International Development Research Centre.
Rouleau, M. D., Lind-Riehl, J. F., Smith, M. N., & Mayer, A. L. (2016). Failure to communicate: Inefficiencies in voluntary incentive programs for private forest owners in Michigan. *Forests, 7*(9), 199.
Sagor, E. S., Kueper, A. M., Blinn, C. R., & Becker, D. R. (2014). Extension forestry in the United States: A national review of state-level programs. *Journal of Forestry, 112*(1), 15–22.
Saldaña, J. (2009). *The coding manual for qualitative researchers.* London: Sage Publications.
Salwasser, H. (1993). Sustainability needs more than better science. *Ecological Applications, 3*(4), 587–589.
Santo, A. R., Sorice, M. G., Donlan, C. J., Franck, C. T., & Anderson, C. B. (2015). A human-centered approach to designing invasive species eradication programs on human-inhabited islands. *Global Environmental Change, 35*, 289–298.
Sarantakos, S. (2012). *Social research.* New York: Palgrave Macmillan.
Sayer, J., Sunderland, T., Ghazoul, J., Pfund, J.-L., Sheil, D., Meijaard, E., et al. (2013). Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. *Proceedings of the National Academy of Sciences, 110*(21), 8349–8356.
Seto, K. C., Fragkias, M., Güneralp, B., & Reilly, M. K. (2011). A meta-analysis of global urban land expansion. *PloS One, 6*(8), e23777.
Shindler, B., & Cramer, L. A. (1999). Shifting public values for forest management: Making sense of wicked problems. *Western Journal of Applied Forestry, 14*(1), 28–34.
Smail, R. A., & Lewis, D. J. (2009). *Forestland conversion, ecosystem services, and economic issues for policy: A review.* Pacific Northwest Research Station, Portland, OR: USDA Forest Service.
Stein, S. M., McRoberts, R. E., Mahal, L. G., Carr, M. A., Alig, R. J., Comas, S. J., et al. (2009). *Private forests, public benefits: increased housing density and other pressures on private forest contributions. General technical report PNW-GTR-795*. Pacific Northwest Research Station, Portland, OR: US Forest Service.
Stein, S., Carr, M., McRoberts, R. E., & Mahal, L. G. (2012). Forests on the edge: the influence of increased housing density on forest systems and services. In D. N. Laband, B. G. Lockaby, & W. Zippere (Eds.). *Urban–rural interfaces: linking people and nature*Madison, WI: American Society of Agronomy, Soil Science Society of America, Crop Science Society of America pp. 53711-5801.
Stein, S. M., McRoberts, R. E., Alig, R. J., Nelson, M. D., Theobald, D. M., Eley, M., et al. (2005). *Forests on the edge: Housing development on America's private forests.* Pacific Northwest Research Station, Portland, OR: USDA Forest Service.
Stone, R. S., & Tyrrell, M. L. (2012). Motivations for family forestland parcelization in the Catskill/Delaware watersheds of New York. *Journal of Forestry, 110*(5), 267–274.
Swart, R. J., Raskin, P., & Robinson, J. (2004). The problem of the future: Sustainability science and scenario analysis. *Global Environmental Change, 14*(2), 137–146.
The World Bank (2006). Sustainable land management: Challenges, opportunities and trade-offs, Washington, DC.
Theobald, D. M., Hobbs, N. T., Bearly, T., Zack, J. A., Shenk, T., & Riebsame, W. E. (2000). Incorporating biological information in local land-use decision making: Designing a system for conservation planning. *Landscape Ecology, 15*(1), 35–45.
Thompson, J. R., Lambert, K. F., Foster, D. R., Broadbent, E. N., Blumstein, M., Zambrano, A. M. A., & Fan, Y. (2016). Four land-use scenarios and their consequences for forest ecosystems and services they provide. *Ecosphere, 7*(10), e01469.
Thompson, J. R., Plisinski, J. S., Olofsson, P., Holden, C. E., & Duveneck, M. J. (2017). Forest loss in New England: A projection of recent trends. *PloS One, 12*(12), e0189636.
Vickery, B. W., Germain, R. H., & Bevilacqua, E. (2009). Urbanization's impact on sustained yield management as perceived by forestry professionals in central New York. *Forest Policy and Economics, 11*(1), 42–49.
Visser, W., Crane, A. (2010). Corporate sustainability and the individual: Understanding what drives sustainability professionals as change agents (February 25, 2010). Available at SSRN: https://ssrn.com/abstract=1559087.
Wade, D., & Moseley, C. (2011). Foresters' perceptions of family forest owner willingness to participate in forest carbon markets. *Northern Journal of Applied Forestry, 28*(4), 199–203.
Wear, D. N. (2011). *Forecasts of county-level land uses under three future scenarios: a technical document supporting the Forest Service 2010 RPA Assessment. Gen. Tech. Rep. SRS-141*. Southern Research Station, Asheville, NC: US Department of Agriculture Forest Service.
Webb, R., Bai, X., Smith, M. S., Costanza, R., Griggs, D., Moglia, M., et al. (2018). Sustainable urban systems: Co-design and framing for transformation. *Ambio, 47*(1), 57–77.
Withrow-Robinson, B., Allred, S. B., Landgren, C., & Sisock, M. (2013). Planning across generations: Helping family landowners maintain their ties to the land. *Journal of Extension, 51*, 5.